Claims

1. A method for determining an actual value of at least one system parameter or a deviation from a desired value of at least one system parameter of an eye treatment system (1; 25; 37; 46) by means of a treatment laser beam (3) emitted by said eye treatment system, wherein a surface of a calibrating body (11) is ablated by at least one partial beam of the treatment laser beam (3) according to a predetermined ablation program, the surface ablated by the treatment laser beam (3) is examined by means of aberrometry and/or profilometry, and the actual value of the sytem parameter or the deviation from the desired value of the system parameter is determined on the basis of examination data determined during examination.

2. The method as claimed in Claim 1, wherein a calibrating body (11), which is plate-shaped in the area to be ablated, is used for ablation.

3. The method as claimed in Claim 1, wherein a calibrating body (11) is used, which has a spherical shape at least in the area to be ablated and to be examined.

4. The method as claimed in Claim 1, wherein a calibrating body is used, which comprises a surface portion to be ablated at least partially, said surface portion having the shape of the corneal portion of the eye (40) to be treated.

5. The method as claimed in any one of the preceding Claims, wherein a polymethylmethacrylate calibrating body is used as the calibrating body (11).

6. The method as claimed in any one of the preceding Claims, wherein a calibrating body (11) is used, which is not transmitting for a wavelength of optical radiation used for measurement during aberrometry or profilometry.

7. The method as claimed in any one of the preceding Claims, wherein a filter is used to separate the treatment laser beam from the optical radiation used for examination.

8. The method as claimed in any one of the preceding Claims, wherein the calibrating body (11) is arranged in the working plane of the treatment system (1; 25; 37; 46), or in an equivalent plane, during examination.

9. The method as claimed in any one of the preceding Claims, wherein the method is carried out during treatment of the eye (40).

10. The method as claimed in Claim 9, wherein the treatment laser beam (3) is alternately directed on the eye (40) and on the calibrating body (11).

11. The method as claimed in Claim 9, wherein the treatment laser beam (3) is split, and wherein the calibrating body (11) is ablated with one part of the beam and the eye (40) is treated with the other part of the beam.

12. The method as claimed in any one of the preceding Claims, wherein a measurement ray bundle (15), which is used for examination of the calibrating body (11), is coupled, colinear to the treatment laser beam (3) or to a partial beam (43) split off said beam, into the beam path of the treatment laser beam or of the partial beam so as to ablate the calibrating body (11).

13. The method as claimed in any one of the preceding Claims, wherein, in order to examine the ablation condition of the ablated calibrating body (11) by means of aberrometry, acquisition and evaluation of data relating to a wavefront influenced by the ablated calibrating body (11) or a modification of said wavefront is effected.

14. The method as claimed in any one of the preceding Claims, wherein an optically operating method is used for profilometry.

15. The method as claimed in any one of the preceding Claims, wherein the actual values or the deviations from corresponding desired values are determined from the same examination data for at least two system parameters.

16. The method as claimed in any one of the preceding Claims, wherein the deviation of the actual value of the system parameter from the desired value or the deviations of the actual values of the system parameters from the desired values is/are determined on the basis of a comparison of the examination data with corresponding reference data.

17. The method as claimed in Claim 16, wherein a reference body having a predetermined ablation pattern is examined by aberrometry and/or profilometry, and the examination data obtained are used as reference data.

18. The method as claimed in Claim 16 or 17, wherein the method is carried out in a cyclic manner, and reference data for the current cycle are determined from examination data of a preceding cycle.

19. The method as claimed in any one of the preceding Claims, wherein at least one value for a correction parameter of the treatment system (1; 25; 37; 46) is determined as a function of the determined actual value of the system parameter or the determined actual values of the system parameters and/or of the deviation of the system parameter from the desired value or the deviations of the system parameters from the desired values, said value for the correction parameters being suitable to reduce at least one deviation from a desired condition or function.

20. The method as claimed in any one of the preceding Claims, wherein at least one corresponding setting of an adjusting unit of the treatment system (1; 25; 37; 46) is modified as a function of the determined actual value of the system parameter or the determined actual values of the system parameters and/or of the deviation of the system parameter from the desired value or the deviations of the system parameters from the desired values, in order to reduce deviations from a desired condition or function.

21. The method as claimed in any one of the preceding Claims, wherein a program for modification of the position and/or intensity of the treatment laser beam (3) over time in order to achieve a predetermined ablation profile or at least one parameter value for the program is modified according to the actual value of the system parameter or the actual values of the system parameters and/or the deviation of the system parameter from the desired value or the deviations of the system parameters from the desired values.

22. The method as claimed in any one of the preceding Claims, wherein the setting of the treatment system (1, 25; 37, 46) is changed automatically, on the basis of the actual value of the system parameter or of the actual values of the system parameters or of the deviation of the system parameter from the desired value or of the deviations of the system parameters from the desired values, in order to reduce the deviation between actual value and desired value or the deviations between actual values and desired values.

23. A system parameter determining device for determining at least one actual value of a system parameter or a deviation from a desired value of at least one system parameter of a system (1; 25; 37; 46) for treatment of an eye (40) by means of a treatment laser beam (3) emitted by said system (1; 25; 37; 46), said device comprising a unit (8) for examining at least one portion of an ablated surface of an ablated calibrating body (11) by aberrometry and/or profilometry, and an evaluating unit (9; 28) connected to the examining unit (8), by means of which evaluating unit the actual value of the system parameter or the deviation from the desired value of the system parameter can be determined on the basis of the examination data determined during examination.

24. The system parameter determining device as claimed in Claim 23, wherein a filter, which does not transmit optical radiation having the polarization and/or wavelength of the treatment laser beam, is arranged preceding a photo detector of the examining unit in the beam path of the examining unit.

25. The system parameter determining device as claimed in Claim 23 or 24, wherein the examining unit (8) comprises an aberrometer (12) working on the basis of wavefront data.

26. The system parameter determining device as claimed in Claim 25, wherein the aberrometer (12) comprises a Hartmann-Shack sensor.

27. The system parameter determining device as claimed in any one of Claims 23 to 26, wherein the examining unit comprises an optically operating profilometer.

28. The system parameter determining device as claimed in any one of Claims 23 to 27, wherein the evaluating unit (9; 28) is adapted for determining an actual value and/or a deviation from a corresponding desired value from the same examination data for at least two system parameters.

29. The system parameter determining device as claimed in any one of Claims 23 to 28, wherein the evaluating unit (9; 28) is adapted to determine the deviation of the actual value of the system parameter from the desired value or the deviations of the actual values of the system parameters from the desired values by comparing the examination data with corresponding reference data.

30. The system parameter determining device as claimed in Claim 29, wherein the system parameter determining device comprises a memory for storing the reference data.

31. The system parameter determining device as claimed in Claim 29 or 30, wherein the system parameter determining device comprises a reference body having a predetermined reference ablation pattern.

32. The system parameter determining device as claimed in any one of Claims 29 to 31, wherein the evaluating unit is adapted to determine, during cyclic detection of examination data, reference data for the current cycle from examination data of a preceding cycle.

33. The system parameter determining device as claimed in any one of Claims 23 to 32, wherein a correction value determining device is provided by means of which at least one value

for a correction parameter of the treatment system (1; 25; 37; 46) is determined as a function of the determined actual value of the system parameter or the determined actual values of the system parameters and/or of the deviation of the system parameter from the desired value or the deviations of the system parameters from the desired values, said value for a correction parameter being suitable to reduce deviations from a desired condition or function.

34. A system for the treatment of an eye (40), said system comprising a treatment laser for emitting a treatment laser beam (3), a deflecting unit (5) for deflecting the treatment laser beam (3), a control unit (6, 27) by means of which the emission and positioning of the treatment laser beam (3) in space and time can be controlled, a holder (10; 36) for a calibrating body (11) which can be ablated by at least one partial beam of the treatment laser beam (3) emitted by the treatment system (1; 25; 37; 46), as well as a system parameter determining device (7; 26; 39) for determining at least one actual value of a system parameter of the system (1; 25; 37; 46) or a deviation from a desired value of at least one system parameter of the system (1; 25; 37; 46) as claimed in any one of Claims 23 to 33.

35. The system as claimed in Claim 34, wherein the holder (10; 36) is movable in and out of a treatment beam path of the treatment system (1; 25; 37; 46).

36. The system as claimed in Claim 35, wherein the examining unit (8), as a unit with the holder (10; 36), is supported at or on a carrier of the treatment system (1; 25; 37; 46) and movable in and out of the treatment beam path.

37. The system as claimed in any one of Claims 34 to 37, wherein a mirror unit comprising a mirror (38), which is movable between two positions, is arranged such that the treatment laser beam (3) is directable onto the eye (40) or onto the calibrating body (11) according to the position of the mirror (38).

38. The system as claimed in Claim 37, wherein the mirror is movable back and forth between the two positions by a drive.

39. The system as claimed in Claim 38, wherein the movement of the mirror is synchronized with the emission of the treatment laser beam (3).

40. The system as claimed in any one of Claims 34 to 39, wherein a beam splitter (41) is arranged in the treatment beam path of the treatment system (1; 25; 37; 46), by means of which beam splitter a partial beam (43) can be split off from the treatment laser beam (3) for ablation

of the calibrating body (11), which is held in the holder (18; 36) outside the treatment beam path.

41. The system as claimed in any one of Claims 37 to 40, wherein at least the mirror (38) of the mirror unit or the beam splitter (41) is arranged following focussing optics (4) or the deflecting unit (5) of the treatment system (1; 25; 37; 46).

42. The system as claimed in any one of Claims 34 to 41, wherein the aberrometer (12) or the profilometer of the examining unit (8) is integrated in the treatment system (1; 25; 37; 46).

43. The system as claimed in Claim 42, wherein the aberrometer (12) and/or the profilometer can be used for the examining unit (8) in the treatment system (1; 25; 37; 46) for examining the eye (40).

44. The system as claimed in any one of Claims 34 to 43, wherein a measurement beam path of the examining unit (8) is at least partially colinear with a beam path of the treatment laser beam or of a partial beam (43) split off therefrom for ablation of the calibrating body (11).

45. The system as claimed in any one of Claims 34 to 44, wherein the system parameter determining device (7; 26; 39) for determining an actual value of the system parameter or a deviation from a desired value or the control unit (6, 27) comprises a correction value determining device, by means of which as a function of the determined actual value of the system parameter or of the actual values of the system parameters and/or of the deviation of the system parameter from a desired value or the deviations of the system parameters from desired values, at least one value for a correction parameter is determined for the treatment system (1; 25; 37; 46), said value being suitable to reduce deviations from a desired condition or function.

46. The system as claimed in any one of Claims 34 to 45, wherein the evaluating unit (9; 28) is connected to the control unit (6, 27), and the control unit (6, 27) is provided such that, on the basis of the actual value of the system parameter or of the deviation of the system parameter from the desired value, the position of at least one adjusting unit of the treatment system (1; 25; 37; 46) can be changed.

47. The system as claimed in any one of Claims 34 to 46, wherein the evaluating unit is connected to the control unit (6, 27) and the control unit (6, 27) is adapted such that, on the basis of the actual value of the system parameter or the actual values of the system parameters and/or of the deviation of the system parameter from the desired value or the deviations of the

system parameters from the desired values, a program for changing the position and/or intensity of the treatment laser beam (3) over time, or at least one parameter value for the program, is modifiable in order to achieve a predetermined ablation profile.

48. The system as claimed in any one of Claims 34 to 47, wherein the evaluating unit (9; 28) is connected to the control unit (6, 27) and the evaluating unit and/or the control unit (6, 27) is provided such that, on the basis of the actual value of the sytem parameter or the actual values of the system parameters or of the deviation of the system parameter from the desired value or the deviations of the system parameters from the desired values, the setting of the treatment system (1; 25; 37; 46) can be changed automatically to reduce the deviation between actual value and desired value or the deviations between actual values and desired values.